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17 March 1970

DEVELOPMENT OBJECTIVES
DESIGN CONCEPT FOR A COLOR CONTROL CELL

1. INTRODUCTION

These development objectives describe requirements to be met in the preparation of a Design Concept for a Color Control Cell, a facility which will provide the proper environment in which to carry out photo interpretation and photo-scientific experiments on a new family of high resolution, color reconnaissance photography taken at very high altitudes.

2. BACKGROUND

2.1. As a result of great improvements in the imaging characteristics of aerial color film in recent months, increasing amounts of such film are being flown for the assessment of Essential Elements of Information (EEI's) related to the use of color imagery in military reconnaissance. This trend is expected to accelerate in the next several years, as development continues on presently less-than-optimum copy film for reproduction of working copies. It is anticipated that product improvement of both original and copy material will continue, necessitating a continuing R&D effort in several categories of color reconnaissance film utilization.

2.2. Specifically, several initial studies are starting in the areas of: (a) establishing processing, viewing, and reporting standards for color-oriented Essential Elements of Information (EEI's); (b) developing and modifying equipment to permit optimum copying of photographic color originals; (c) analyzing the effect of the new color film structure on the continuing requirement for accurate mensuration of photographic images; (d) developing a plan for training all types of personnel who must exploit color photography.

2.3. These studies are not a part of this project; however, results from these programs need to be correlated with the subject design concept for the Color Control Cell (CCC) to the extent possible within the time frame of this contract. Similarly, the contractor for the CCC design concept will be required to stay cognizant of continuing improvements in the development of the new high resolution color films, which involve unique coating and arrangement of film layers.

3. CONCEPT

3.1. Purpose - It is the primary purpose of this study to develop a design concept for a facility with which to, first, neutralize the environment and then study the effect of manipulating that environment while conducting PI and photo-scientific tasks. An important sub-task, and perhaps the guiding principle behind the design concept, is accommodation for

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accurate color discrimination (identification). In other words, the CCC should neutralize visual phenomena which would otherwise interfere with accurate film image color identification by the human visual apparatus.

3.2. Scope - This study shall produce a thorough report detailing the results of the contractor's analyses and defining, in general terms, the physical and functional characteristics of the Color Control Cell and equipment therein. During the course of his study, the contractor will examine the theoretical problems of using existing PI and photo-scientific equipments to analyze the new color films and make general recommendations for their modification. The scope of this effort will not include detailed designs at this time.

4. REQUIREMENTS

4.1. Functions of the Color Control Cell

4.1.1. Environment - The CCC must be usable to conduct meaningful experiments to define and develop optimized techniques for interpreting and analyzing the new families of color reconnaissance films. To achieve such purposes, the selected contractor may determine that illumination (both environmental and instrument) should be "modifiable" as to color characteristics. Similarly, consideration must be given to convertible or flexible work space configurations and surface colors to permit testing of theoretical arrangements. In studying this, the response of the human eye and the limits and types of visual anomalies permissible will be considered by the contractor.

4.1.2. Photo Interpretation Experiments - The design concept for the Color Control Cell shall be consistent with future human factors research and experimentation with existing PI light tables, microstereoscopes, and projection viewers. When completed, the CCC must permit the test and evaluation of certain specialized light tables and rear projection viewers equipped with light sources capable of chromatic manipulation. Such instrumentation is either under development or being considered for funding under separate efforts. In follow-on programs to this design concept study, the impact of the new color films, displayed on the above equipments in the CCC, will be categorized and studied as to phases of PI activities (detection, identification, interpretation) and target types. To the degree possible within the scope of this conceptual study, the contractor will consider the relevance and limits of image luminance requirements and magnification while viewing color films, and the extent to which optics and light sources of viewing instruments must be modified or newly developed to be in accord with the ranges of environmental adjustment recommended in the resulting design concept for a Color Control Cell.

4.1.3. Photo-Scientific Experiments - Within the Color Control Cell, numerous objective and subjective color film assessments and evaluations must be made, which are those of the photo-scientist, as

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opposed to those of the photo interpreter. It may be possible to conduct such evaluations concurrently (or alternately) within a single cell configuration, or it may be necessary to differentiate between categories by setting up a second Color Control Cell. The design concept for the CCC must recommend between these choices and must accommodate expansions of such current evaluations as:

- Comparative studies between two different camera systems or missions.
- Changes in images produced by deviations within a mission.
- Performance comparisons between emulsions, lenses, printers, and processors.
- System and film assessment of anomalies in resolution, density, contrast, color balance, color saturation, exposure, illumination, obliquity, focus, image motion compensation, astigmatism, chromatic aberration, light leaks, vibration, contaminated processing solutions, chemical precipitation, improper light sources, filtration, magnification.
- Studies in preparing optimum density/contrast reproductions.
- Color separation studies and analysis of the interactions between color film layers.
- Image quality grading studies.

4.2. Color Definition

4.2.1. Standards - The selected contractor will coordinate with a parallel effort under way to establish a system of standards by which photo interpreters can properly identify film image colors in a manner useful for intelligence purposes. With major emphasis on utilization with film transparencies, all pertinent color measuring systems (e.g., Munsell, ISCC-NBS, C.I.E., Densitometric-Munsell) are being considered; in support of the latter physical technique, generation of a chromaticity grid to determine C.I.E. coordinates on the new original color film has been proposed for funding. With these inputs, the sponsor is planning to start from a base defined recently by the USA Standards Institute for viewing and comparing color transparencies in the Graphic Arts and related industries, supplemented by specifications from the Illuminating Engineering Society. From that base, appropriate modifications will be applied for dealing with any special requirements for photo interpretation and photo-scientific analysis, and these modifications will be made available for the CCC design concept.

4.2.2. Techniques - It is required, additionally, that the design concept formulate techniques by which image colors may be effectively differentiated and identified, in the context of the yet-to-be-established color viewing and reporting standards. Determination of tolerances to which color information should be obtained may well depend upon the optimum method. It is required that consideration be given to both human visual and photo-electric (machine) techniques, even though the foregoing CCC design concept emphasizes the visual effects. Equipment candidates for

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visual techniques include existing PI light tables, microstereoscopes, and projection viewers; versions of commercial photo assessment viewers; a proposed visual tri-chromatic colorimeter; an existing monoscopic colorimeter design; and optical techniques of split field and "flicker", in general. Among the "machine" techniques, the contractor should consider the utility of existing or conceptualized photo-electric colorimeters, densitometers, spectrophotometers, and spectral radiometers. In this area, also, coordination with other on-going efforts in this office will be required (as indicated in section 4.2.1). While the selected contractor must consider all these concepts, he should not be limited to them in developing the overall design concept.

5. MISCELLANEOUS

5.1. Reporting - The contractor will be required to provide monthly reports and a Final Report. The monthly reports will follow the DB-1001 specification attached. The final report will provide a complete design concept, upon which a follow-on detailed design can be directly based. The final report must be completed within 30 days of the completion of the investigations and within the allowable cost of the contract.

5.2. Proposal Format - The submitted proposal will conform to the attached guide for proposal format.

5.3. Level of Effort - It is desired that this study consume no more than four months from contract initiation.

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PROPOSAL FORMAT

All Proposals Must Include the Following Information:

- I. Task Abstract: Contents - Synopsis of task within 12 lines, plus estimated cost of direct labor, material, overhead, G&A, fee, total.
- II. Introduction: Contents - Covering background and task justification rationale.
- III. Technical Discussion: Contents - Detail and subsections as a function of the task.
- IV. Work Statement: Contents - This statement should succinctly describe the individual tasks to be done and should be sufficiently definitive that one may read this section to understand the purpose and scope of the tasks.
- V. Deliverable Items: Contents - 1) Interim and Final reports
2) Equipment
- VI. Schedule of the project percentage of completion of performance by months and related schedule of percentage of project expenditures by month in tabular form.
- VII. Time Bar Chart
- VIII. Financial Considerations: Contents - Cost details, summary, GFE required.

CONTRACTUAL DOCUMENTATION TO BE SUPPLIED BY CONTRACTORS

1. SCOPE

- 1.1 This Specification covers the contractual documentation to be supplied by contractors in the performance of Research and Development contracts.

2. REQUIREMENTS

- 2.1 General - In order to maintain proper control the progress and funding of Research and Development contracts, it is necessary that certain orderly reporting be accomplished by the Contractor on a regularly scheduled basis.

2.1.1 All documentation submitted by the Contractor shall bear the control number assigned by the Contracting Officer's Technical Representative. This control number shall appear on all correspondence, reports, etc., submitted by the contractor under the contract.

- 2.2 Types of Reports - The following types of reports shall be submitted by the contractor. Specific reports shall include, but not necessarily be limited to, the designated information.

2.2.1 Monthly - A monthly report shall be prepared as of the last working day of each calendar month. The first monthly report shall be prepared as of the last working day of the first full calendar month subsequent to the date of contract. Monthly reports shall be mailed so as to reach the consignee(s), stated in the contract, not later than the first business day after the fifteenth of the month following the reporting period. Each Monthly report shall provide the following, with negative reporting if applicable.

2.2.1.1 A statement of the activity on the project during the month and the percentage of work completed as of the reporting date.

- 2.2.1.2 A statement of the planned activity for the next month.
- 2.2.1.3 A statement of pending, unresolved technical problems.
- 2.2.1.4 A statement of pending, unresolved contractual problems.
- 2.2.1.5 A statement for the record, of agreements or understandings reached orally during the reporting period on technical matters not requiring the approval of the Contracting Officer.
- 2.2.1.6 A statement of any proposed change, agreement or understanding which requires the approval of the Contracting Officer. The contractor is cautioned not to proceed in a situation requiring the prior approval of the Contracting Officer until such approval has been obtained. In situations requiring correspondence with the Contracting Officer, a complimentary copy shall be forwarded, simultaneously, directly to the Contracting Officer's Technical Representative.
- 2.2.1.7 A statement of unanswered, unresolved matters, unanswered correspondence, etc., and whether delinquency is attributed to the contractor or to the Government.
- 2.2.1.8 Status of funds. The format shown in Enclosure 1 shall be used to report the status of funds. All applicable items shall be reported. If no expenditures or obligations have been incurred for a specific item, the word "None" shall be entered in the space assigned for the dollar amount.
- 2.2.2 Final Report - The final report shall be submitted to the Contracting Officer's Technical Representative on or before the thirtieth day following completion of the work under the contract. This report shall cover the entire design and/or development work accomplished during the period of performance and shall contain a section covering the work performed under each of the tasks set forth in the Work Statements. The report shall state concisely but completely the major problems encountered, the apparent cause of the problems, the problem solutions and an evaluation of the solutions based on actual application of the solutions.

2.2.3 Installation Engineering Data - Whenever hardware is a deliverable item under a contract the contractor shall provide the Installation Engineering Data requested on Enclosure 2. The Contracting Officer's Technical Representative shall provide the blank forms to the Contractor. Preliminary data shall be submitted to the Contracting Officer's Technical Representative at six months and again at three months prior to the delivery date of the equipment. Final data shall be submitted by the contractor not less than thirty days prior to the delivery of the equipment.

2.2.3.1 The outline drawing, submitted with the Installation Engineering Data form shall show:

- (a) the orientation of the equipment within the work area for normal equipment useage.
- (b) the exact location of all external connections.
- (c) the clearance required around the equipment for access to all removeable panels, doors, etc.
- (d) the location of mounting points and type of mounting required.

2.3. Delivery of Reports - All monthly reports and the final report shall be forwarded by the contractor to the Consignee(s) specified in the contract. The contractor shall forward each report in the number of copies specified in the contract.

2.3.1 The Installation Engineering Data form plus the outline drawing shall be forwarded to the Contracting Officer's Technical Representative.

Statement of Funds as of 30 September 19XX (See Note 1)

EXPENDITURES

1. Labor:

a. Total paid as of 31 August 19XX	XX,XXX	
b. Paid during September 19XX	<u>X,XXX</u>	
c. Sub-total		XX,XXX

2. Material:

a. Total paid as of 31 August 19XX	X,XXX	
b. Paid during September 19XX	<u>XXX</u>	
c. Sub-total		X,XXX

3. Services (sub-contracts, etc.):

a. Total paid as of 31 August 19XX	X,XXX	
b. Paid during September 19XX	<u>XXX</u>	
c. Sub-total		X,XXX

4. Total expenditures as of 30 September 19XX		XX,XXX
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OBLIGATIONS AND ESTIMATES

5. Obligations:

a. Sub-contract W/ABC Co., amount not yet paid	X,XXX	
b. Sub-contract W/DEF Co., amount not yet paid	XXX	
c. Material ordered but not yet paid for	<u>XXX</u>	
Sub-total		X,XXX

6. Estimates of Future Expenditures:

a. Estimate of labor required	X,XXX	
b. Estimate of material required	XXX	
c. Proposed sub-contracts	<u>XXX</u>	
Sub-total		X,XXX

Total		XX,XXX
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NOTES:

1. All amounts shown above must include overhead, G&A, handling charges, fees, etc.

INSTALLATION ENGINEERING DATA

Date form completed _____

(See Remarks at end of form)

Tentative ☐ Valid until _____

Final data ☐

I. INSTRUMENT

- A. Name of instrument: _____
B. Manufacturer: _____
C. Contract number: _____
D. Delivery date: Tentative: _____ Final: _____

II. PHYSICAL FEATURES

- A. Sub-assemblies:
1. Number of sub-assemblies: _____
2. Largest sub-assembly: Weight _____ lbs; _____" H x _____" W x _____" D
3. Heaviest sub-assembly: Weight _____ lbs; _____" H x _____" W x _____" D
B. Assembled instrument:
1. Number of major components: _____
2. Largest component: Weight _____ lbs; _____" H x _____" W x _____" D
3. Heaviest component: Weight _____ lbs; _____" H x _____" W x _____" D
4. Total floor space required after assembly, including maintenance access space: _____ Ft. _____ In. High x _____ Ft. _____ In. Wide x _____ Ft. _____ In. Deep.
5. Total weight of assembled instrument: _____ lbs.
C. Type of base of mount: Flat _____; 3-point suspension _____; 4-point suspension _____
D. Does the instrument have built-in mobility? Yes _____ No _____
E. Is the instrument particularly sensitive to vibration? Yes _____ No _____
Will the instrument generate vibration? Yes _____ No _____
F. Are any special or unusual tools or fixtures necessary or advisable for the installation of the maintenance of this instrument? Yes _____ No _____.
If "Yes," please describe: _____

III. UTILITIES

- A. Electrical:
- | | | |
|--|---|----------------------------------|
| 1. Voltage | _____ Volts $\frac{AC}{/}$ _____ Volts | _____ Volts $\frac{DC}{/}$ _____ |
| 2. Current | _____ Amps/phase | _____ Amps |
| 3. Frequency | _____ cps | |
| 4. Nr. of phases | _____ Ph | |
| 5. Nr. of wires | _____ | |
| 6. Power required | _____ Watts | _____ Watts |
| 7. Power factor | _____ (Leading) (Lagging) | |
| 8. Type of outlet: | Two prong _____; three prong _____; Twist lock _____; Perm. _____ | |
| 9. Type of ground: | Building conduit _____; Direct earth ground _____ | |
| 10. Should the instrument be shielded, either from external electromagnetic signals or to prevent interference with other equipment? | Yes _____ No _____ | |
- If "Yes," to what extent? _____

B. Air conditioning:

1. Desired environment: Room air temperature of ____ °F / ____ °F and relative humidity of ____ % / ____ %.
2. Input Air: Is a direct connection necessary? Yes ____ No ____; Advisable? Yes ____ No ____; If "Yes," what is the connector type and size? ____ Recommended input air temperature ____ °F / ____ °F. Relative humidity ____ % / ____ %. If input air must be filtered, what is the maximum particle size in microns? ____ What particle count? ____ / cu. ft.
3. Output Air: Is a direct connection to the return air duct necessary? Yes ____ No ____. Advisable? Yes ____ No ____. Connector type and size? ____ Output air temperature ____ °F / ____ °F. Relative humidity ____ % / ____ %. Output heat ____ BTU/Hr. Flow of ____ CFM. Is output air toxic? Yes ____ No ____; Noxious? Yes ____ No ____.

C. Plumbing:

1. Is water required? Yes ____ No ____; Pressure ____ PSIG, flow ____ GPM.
2. Type of water required:
Tap ____ °F / ____ °F Deionized ____ °F / ____ °F
Tempered ____ °F / ____ °F Filtered ____ °F / ____ °F
If filtered, give maximum permissible particle size in microns and the maximum permissible count. ____ microns ____ particles/cu. ft.
3. Pipe required:
Galvanized ____ Copper ____ Size ____
Stainless Steel ____ Plastic ____ Type of connector ____
4. Floor drain:
Diameter of drain ____ Galvanized drain? ____
Plastic drain? ____ Glass drain? ____
5. Are any chemical solutions used in the device? Yes ____ No ____. If "Yes," state the nature of the solution(s), permissible temperature range, flow rate in appropriate units and the filtration necessary for each solution ____.
6. Size of pipes and connectors ____.

D. Compressed air:

Is compressed air required? Yes ____ No ____ Water free? ____ Oil Free? ____
Type and size of connector? ____ Pressure ____ PSIG. Flow in CFM ____
Maximum ____, minimum ____, average ____.

E. Vacuum:

Is vacuum required? Yes ____ No ____ Pressure ____ PSIA or (inches of water) (millimeters of mercury). Displacement in CFM, maximum ____, minimum ____, average ____ Type and Size of connectors ____.

F. Peripheral Devices:

Will the instrument be connected to any peripheral devices such as a computer or data input or data output device? Yes ____ No ____ If "Yes," give, in detail, the nature of the connection to the peripheral device such as coaxial cable, multiple wire connector, etc.

IV. REMARKS

- A. Use additional sheets if more space is required for environmental conditions or utilities not mentioned above.
- B. Submit three typed copies of the completed form to the Technical Representative.

- C. Attach three copies of a dimensioned outline drawing of each major component and of the completed assembly. Include the estimated weight of each major component and of the completed assembly. Indicate, on the outline drawing of the completed assembly, the space required for access to the instrument for maintenance.
- D. If a question does not apply to the instrument, insert "N/A" (Not Applicable) in the appropriate blank space.

Information provided by:

(Signature)

(Position or job title)